Got Risk?

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Talk to Clay Struve, quant savant. He's the guy that big money banks on.

It's the day before Black Monday, 1987, and like the rest of the world Clay Struve has no idea that tomorrow the Dow will have its worst day ever. Yet he is uneasy enough with the "weirdness in the air" that he goes into work on a Sunday afternoon.

In the office, he and his team race to recalculate the risk scenarios by which O'Connor & Associates, the secretive Chicago options-trading firm where he is a 28-year-old partner, manages its portfolio. When the software guys get stuck, it's Struve, a nonprogrammer, who intuits the fix by analyzing the batch of data causing the problems and then steering a solution. By the next morning – before the market accelerates into a 23 percent free fall – Struve's team has mapped, and begins executing, a strategy to survive a 24 percent plunge.

O'Connor still takes a big hit, giving up its gains for what had been a very good year, but it actually makes money on the option portfolio Struve modeled. The firm, a market maker that trades options amounting to almost 5 percent of the daily volume on the New York Stock Exchange, endures a Darwinian moment and lives to trade another day. "We got killed on our risk-arbitrage positions, but the system held up fine," Struve reflects. "Our winners helped us lose a half-ton instead of a ton."

It would not be entirely accurate to say that Struve (rhymes with *groovy*) made his reputation as a risk manager that Monday, in that he was already known as a boy genius within O'Connor and has remained largely unknown to the rest of the world since. People in Struve's line of work don't really want to be widely known anyway, since they usually make the news only when they lose several billion dollars, like the lauded economists who launched last year's hedge fund Hindenburg, Long-Term Capital Management. But at a time when every trading firm has its guru – the quantitative whiz whose ideas feed the computers – few, if any, can match Struve's record for designing risk-management systems that don't blow up. And as his ideas seep into the mainstream, he could yet make the world safe for financial engineering.

For the uninitiated, an option is the right (but not the obligation) to buy or sell a security at a given price before a certain date. Options traders place huge bets on the smallest of movements. It's a high-stakes game where one's ability to accurately calculate price is everything.

Options pricing was revolutionized by the Black-Scholes model, published in 1973 by then-MIT professor Myron Scholes and consultant (and MIT professor-to-be) Fischer Black. It's a complex equation that includes sensitivity of the option's value to such factors as changes in price (delta), the rate of change of the delta (gamma), changes in time (theta), and volatility (vega). The formula earned Scholes a Nobel in economic sciences (Black died before the prize was awarded). But Struve feels it's not comprehensive enough.

The Struve way is not a formula – though it starts with some fancy math – and it's more than the sum of the processing power and 3-D graphics used to enable it. He starts with Black-Scholes and returns frequently to a chart showing the relative rate of return of stocks and bonds over the last four decades, using tools as mundane as Value Line sheets and press releases to flesh out the numerical picture. At the methodology's core is an understanding of the ways markets tend toward improbable disasters, impelled by the self-referential behavior of investors.

Financial engineers have a history of mistaking markets for a rational universe, of looking past the tiny odds of a given cataclysm to the huge streams of cash their models will more likely produce, but Struve seems immune to modelitis. He reads everything, and uses his prodigious knowledge of market history to contextualize the data points on the charts inside his head, sensing the gravitational tug of divergent possibilities, understanding each outlier on the graph as a warning beacon or a killer opportunity.

Struve loves the point of change – such as a takeover or a merger – when stocks tend to move, because it can bring mispricing. He doesn't mind trading in boring old companies like the maker of Morton Salt, and even before this summer's deflation he scoffed at Internet hotties like eBay (he calls it "SanfordandSon.com") as faddish.

The man admits his methodology is cautious – a quality not associated with turn-of-the-millennium markets. But as 1999 draws to a close, Struve says he's ahead of his goal of 20 percent annual returns. ("That's Warren Buffett territory," he says. "I'll take it.") And he prescribes his risk-avoiding methods now especially. "There are places like mortgage-backed securities where people are less prepared than they think," he says. "A lot of the risk-control methods in use are reasonable for reasonable times, but not in crazy times, and most of the people trading today have never seen a real bad time."

And yet despite his intricate knowledge of the markets, the next crisis – wherever it strikes – will most likely unfold without significant direct input from Clay Struve. These days he trades for CSS, a small firm he set up with a few other O'Connor alums, on the 15th floor of a worn-out building on La Salle Street in Chicago's financial district. He's got a glassed-in office, complete with family photos, a copy of one of his favorite books (*The Visual Display of Quantitative Information*), and one of those dummied-up magazine covers showing him as a football star, which is less of a stretch for the burly, mustachioed Bears fanatic than it might be for another math genius. But he doesn't have a job equal to his abilities.

"I could have been the cure for Long-Term Capital," he says, without bravado, of the heavily leveraged hedge fund that had to be rescued by the Federal Reserve with a multibillion-dollar capital infusion. "I'd have thought about helping them if they called."

But the telephone isn't ringing – leaving Clay Struve, for the moment, a vastly undervalued asset.

One of the first times I meet Struve is on a cool Chicago day, and although he's wearing one of his usual off-brand golf shirts, he chooses an outdoor table at a restaurant near the Chicago Board of Trade. The sun has passed behind the top of the western wall of this little urban canyon, but Struve figures that within five minutes its reflected rays will angle off the glass face of the opposing wall to warm us up. He orders a grilled ham-and-American-cheese, fries, and a short Killian's, and sits back to wait for the sun.

We freeze. "The angle was right, but there wasn't enough heat in the reflection for such a windy day," shrugs Struve. This is how he perceives the world, as a series of relationships and variables and angles to be charted and bet on. This innate view of the world has been with him since boyhood – his father, Ted, a retired corporate exec with a PhD in operations research, had Clay working algebra problems before kindergarten. ("Nothing too hard – just solving for an unknown, understanding relationships," says the elder Struve.) As a sports-crazy kid, Clay was fascinated by figuring out all the obscure things that can possibly happen within the rules of baseball or football, however unlikely or bizarre.

> ***Struve loves takeovers and mergers – points of change when mispricing often occurs.***

Years later, armed with an 800 on his math SAT and several charts comparing the relative merits of different colleges, Struve landed at MIT, where he became both a hard-partying Midwestern guy – a frat-house legend and barroom fixture who attended classes on his own schedule – and a scholar of finance who worked with and studied under Fischer Black before graduating in five semesters.

At MIT, he picked up a discipline that would underpin his risk-management methodology. "I learned from Fischer

Black that when you try to sort out the effect of something, you can take it to the extreme and use the extreme to help identify the effects on a small scale," he says, uttering one of his longest sentences of the day.

Upon graduation, Struve took up rugby. On a playing trip to Ireland, he met his future wife, Donna, to whom he proposed with a quantitative discussion of the advantages of the US over Ireland. Married for 15 years, they are intent on raising their children with a minimum of what Struve calls "jet-set BS." They live with two golden retrievers and a Jack Russell terrier named Elmo in a handsome but hardly palatial house, not far from Struve's boyhood home in Evanston.

Struve arrived at O'Connor & Associates in June 1977, at a pivotal moment in financial history. The science of pricing options had been greatly advanced by the Black-Scholes model, but the real-world road testing was being done by firms like O'Connor. "O'Connor stood out – it was an innovator," says Scholes, who after winning the Nobel Prize went on to become one of the failed wise men at Long-Term Capital. "Its use of options and of options-pricing technology showed it really understood the business, especially risk and risk management."

While it may be grandiose to assign any one person credit for developing the risk-management methodology at O'Connor, a powerful but virtually anonymous firm that helped create the modern options business, the firm's members acknowledge Struve as the master in an abstruse field. "His work was known as avant-garde," says Scholes, now a professor emeritus at Stanford.

"The rule was that if Clay said OK, you could do it, and if Clay said no, you couldn't do it. Virtually the entire theory underlying O'Connor's success was invented by Clay," adds Bob Gumerlock, a former O'Connor partner who became the ranking risk-management executive at Swiss Bank Corporation after it acquired the Chicago firm. "The theory belongs to Black and Scholes first, but Struve and O'Connor founder Mike Greenbaum made the option model fly and not crash. He never succumbed to the academic hubris that gets other people into trouble."

In the early '80s, Greenbaum and his protégé, Struve, agreed that dynamic hedging techniques were needed to manage portfolios against ordinary market moves as well as the possibility of shocks. Rather than risking their money on static assumptions, they used those assumptions as a base to continuously uncover the ever changing events that could lead to catastrophe and set up constraints to keep the firm from being exposed to them.

The practical result of Struve's insight has been the technique of constantly stress testing and adjusting portfolios to keep them away from black holes, mapping positions against a broader historical background than that used at many trading houses. Struve's philosophy is basically that complacency is full of shit.

Of course, not everyone subscribes. Struve scorns the softness of big Wall Street companies that gamble with other people's money and lack the discipline to consistently manage risk.

Driving a big options book of thousands of positions is a computationally intensive endeavor, and O'Connor was always a technological trailblazer, an early user of Sun workstations and later one of the few customers of Steve Jobs' career intermezzo, NeXT Software. "We would shred the computer boxes so people wouldn't know what we were doing, because we had stuff that nobody else had," says Craig Heimark, head of technology at O'Connor, and later at Swiss Bank. "We were into symbolics and AI. Our visualization tools [developed in-house] are still better than most of what's out there."

O'Connor was also an early backer of the Prediction Company, the Santa Fe, New Mexico-based firm founded by physicists Doyne Farmer and Norman Packard to create trading software; Struve is still a company director. The Prediction Company uses what is now commonly referred to as "the black box" to look for pricing anomalies and figure risk-adjusted positions. The box sweeps back and forth like a robot to keep things neat and tidy. Trading this way is not Struve's thing, though. "No fun," he grunts.

While technology was a key to the company's strategy, O'Connor prospered by integrating the computers and the math into a superior process – the Struve way, the sum of his perception and knowledge and his toolkit. "A lot of the geeks in QR are pretty good at dueling models," says Heimark, "and Clay understands the details of the models as well as any PhD who builds them, but he is exceptional at understanding how to apply them in a practical environment. He has an innate sense."

Tom Sparks, a former O'Connor colleague who now runs a small trading shop of his own, says Struve stands out in this scientific field because he brings a touch of art to the equation – an ability he gleaned from his mother, Gail, who is an artist: "I think he got a little of that, and he is able to apply it to financial math."

Struve's sense gives him the confidence to disbelieve his own model, or to start the engines on big trades when he believes the numbers speak the truth. He loves the historical anomaly, the stuff outside the models. When, early in his career, Continental Illinois melted down, he decoded the Fed's delphic utterings through a careful reading of central-bank phraseology and then convinced his partners to make a huge bet that the preferred shares alone would be rescued. O'Connor bought as much of the preferred as it could without having to file with the SEC and ended up with a 200 percent return on its investment over a year. "That was seeing something that was either priced really low or really high and figuring out which it was," says Struve.

By the late '80s, O'Connor was looking for a deep-pocketed partner to pursue larger and more diverse positions around the globe. The partners entered a currency venture with Swiss Bank in 1989, which proved to be the first step toward a full sellout in 1994. Soon thereafter, the culture Struve loved began to change. While O'Connor was a tight fraternity – almost literally for Struve, given the 20-odd MIT Lambda Chis who came through the place over the years – Swiss Bank was large and political. Struve struggled. His friend Heimark says Struve's "absurdly high" standards are impossible to maintain at an institution of the scale brought about by the merger. He's not a prima donna – he just won't play politics.

"If he knows he's intellectually right, he doesn't need to be seen as correct by anyone else in the room," says Gumerlock. "He needs a political sponsor – not just for the communication skills but to handle the bullshit of a big organization." Sick of traveling to Switzerland to watch his ideas get bogged down in bureaucracy, Struve left Swiss Bank in October 1997. Ten months later, he and his partners opened CSS.

> ***Big banks like J. P. Morgan once publicly dissed stress testing. Today, they fill their annual reports with paeans to Struve's techniques.***

Struve sits before two monitors in the CSS office, one a Bloomberg terminal and the other a PC with an Excel screen that displays the graphs on stocks he's tracking. The graphs plot price, time, volatility, and other variables in complex patterns of colored lines that look like a failed Mondrian but speak to Struve in his native tongue. Using charts and his brain, drinking Diet Cokes, and talking softly to Mike Fitzgibbons, another O'Connor vet who works the phones and places the trades, Struve can price options on a single stock as well as anybody in the world. Without the computational muscle he left behind at Swiss Bank, though, he can't begin to manage a large portfolio.

CSS is capitalized with about $20 million from the partners and a handful of investors, and recently added index trading to its equities business. Still, for a year-old firm that commands so much intellectual firepower, the place feels sleepy. Some of that is due to the professionalism of its people, but you can't escape the feeling that the 41-year-old Struve is at an intermezzo of his own, facing the existential dilemma: What next?

Certainly Struve is happier than he was at Swiss Bank. He's working with guys he likes, Chicago guys like Fitz and fast-talking Mickey Carusillo (the C in CSS), enjoying an oilcan of Fosters on the early train back to the suburbs, coaching his son and daughter in youth sports. He has time to ski. Maybe he's easing into something big ("We're only about hip-deep so far," he says), and he'll end up rebuilding and advancing the systems he left behind at the bank. Carusillo sure hopes so. "I can build a business around Clay," he says. "We're going to make a lot of money at this."

Meanwhile, Struve's disciples have been busy replicating his meme. Swiss Bank adopted the Chicago risk-management system before being swallowed by one of the world's largest banks, Union Bank of Switzerland, in 1998. Shortly thereafter, UBS was rocked by losses of almost 1 billion Swiss francs in the Long-Term Capital fiasco. Wham. The UBS risk team got canned, and suddenly O'Connor vets were running the show at ground zero of the hedge fund disaster.

Other institutions are also moving toward the Struve way, testing for exposure to shocks several decimal points beyond the seven-sigma probability Gumerlock and others attach to the Long-Term implosion. Big banks like J. P. Morgan & Co., which publicly dissed stress testing in the mid-'90s, now fill annual reports with paeans to the technique. The Basel Committee on Banking Supervision, an international financial-standards group, is reviewing changing its risk-control recommendations to a continuous-assessment model based on historical data instead of one-day numbers. And earlier this year, Alan Greenspan emphasized the need for stress testing and risk mitigation based on searching out and identifying tiny possibilities of catastrophe. "The Struve way is now state religion," says Gumerlock.

But there are still many unbelievers and unenlightened souls, too many market shocks waiting to happen. The question of how to value short options granted by companies to employees demands an intellectually rigorous answer, and Greenspan has testified to Congress about "the technologically driven proliferation of new financial instruments" that lack comprehensive risk control. Experts can't even agree on how to read the metrics by which the stock market values companies. And there's always the prospect of a variable that's not even on the radar. Yet wherever it comes from, disaster will strike.

Meanwhile, Struve, arguably the world's best risk manager, sits on the bench while the scrubs play the game. That is, to be sure, a poor way of managing risk.